PRINTED STORAGE MEDIUM

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Inventor(s): SAWAMOTO NORIHIRO; NAGAI KENICHI; TSUKUDA YASUNORI; KATAYAMA KATSUYUKI
Applicant(s):: STAR MICRONICS CO LTD
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Abstract

PROBLEM TO BE SOLVED: To perform high-quality printing without damaging recording data by stably and securely loading and unloading data into and from a reproducing device and reproducing recorded data.
SOLUTION: In a printed storage medium 19a where an extremely thin thermal color-developing layer 23 is provided on a relatively thick optical recording member 20, the thickness is nearly the same as the specifications of the optical recording member 20, and data can be loaded and unloaded into and from the reproducing device of the medium 19a and recorded data can be reproduced stably and securely. Also, the transfer of heat to the optical recording member 20 in printing can be prevented by the heat-insulating layer between the optical recording member 20 and the thermal color-developing layer 23 or the light- developing member, and the breakdown of the recorded data in the optical recording member 20 can be prevented. Further, the adhesiveness with a thermal head is improved due to the elastic layer between the optical recording member 20 and the thermal color-developing layer 23 or the color-developing member, and the reduction in the adhesiveness due to the warpage of the optical recording member 20 and the difference in thickness can be relaxed, thus achieving a high-quality printing.

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(71)【出願人】
【識別番号】000107642
【氏名又は名称】スター精密株式会社
【住所又は居所】静岡県静岡市中吉田20番10号
(72)【発明者】
【氏名】澤本 則弘
【住所又は居所】静岡県静岡市中吉田20番10号 スター精密株式会社内
(72)【発明者】
【氏名】永井 健一
【住所又は居所】静岡県静岡市中吉田20番10号 スター精密株式会社内
(72)【発明者】
【氏名】佃 保徳
【住所又は居所】静岡県静岡市中吉田20番10号 スター精密株式会社内
(72)【発明者】
【氏名】片山 勝之
【住所又は居所】静岡県静岡市中吉田20番10号 スター精密株式会社内
(74)【代理人】
【識別番号】100075557
【弁理士】
【氏名又は名称】西教 圭一郎 (外3名)
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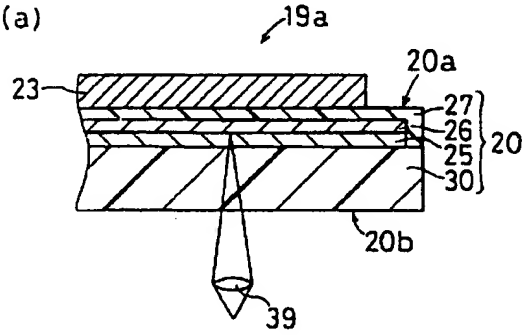
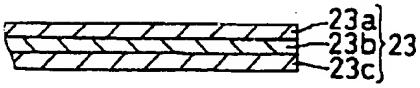
要約

(57)【要約】
【課題】再生装置への出入れや記録データの再生を安定的かつ確実に行い、記録データを破壊することなく高品質な印刷を行う。
【解決手段】比較的厚い光記録部材20の上に極薄い感熱発色層23が設けられる印刷記録媒体19aは、その厚みが光記録部材20のスペックとほぼ同じであり、媒体19aの再生装置への出入れおよび記録データの再生が安定的かつ確実である。また、光記録部材20と感熱発色層23または発色部材との間の断熱層によって、印刷時の熱が光記録部材20へ伝わることが防止され、光記録部材20の記録データの熱による破壊が阻止できる。さらに、光記録部材20と感熱発色層23または発色部材との間の弾性層によって、サーマルヘッドとの密着性が向上し、光記録部材20の反りや厚みの違いによる密着性の低下が緩和され、高品位な印刷が可能となる。

(a)



(b)



請求の範囲

【特許請求の範囲】
【請求項1】光反射層とデータ記録層とを有し、一方がデータ記録読出し面で、他方が印刷表示面で構成される光記録部材と、印刷表示面側に設けられ、熱によって発色する発色層とを備えることを特徴とする印刷記録媒体。
【請求項2】前記光記録部材と発色層との間に、発色時に印加される熱の光記録部材への伝達を防ぐ断熱層を設けたことを特徴とする請求項1記載の印刷記録媒体。
【請求項3】前記光記録部材と発色層との間に、発色時に印加される熱の発色層への伝達を均一化する弾性層を設けたことを特徴とする請求項1または2記載の印刷記録媒体。
【請求項4】光反射層とデータ記録層とを有し、一方がデータ記録読出し面で、他方が印刷表示面で構成される光記録部材と、印刷表示面側に設けられる発色部材であって、熱によって発色する発色層を基材上に有する発色部材と、光記録部材と発色部材との間に設けられ、発色時に印加される熱の光記録部材への伝達を防ぐ断熱層とを備えることを特徴とする印刷記録媒体。
【請求項5】前記光記録部材と発色層との間に、前記断熱層に代わって、発色時に印加される熱の発色層への伝達を均一化する弾性層を設けたことを特徴とする請求項4記載の印刷記録媒体。
【請求項6】前記光記録部材と発色層との間に、前記断熱層に加えて、発色時に印加される熱の

発色層への伝達を均一化する弾性層を設けたことを特徴とする請求項4記載の印刷記録媒体。

詳細な説明

【発明の詳細な説明】
【0001】
【発明の属する技術分野】本発明は、CD(Compact Disk)、CD－ROM(Read Only Memory)およびCD－R(Recordable)などの光記録部材と、熱によって発色する発色層とを備える印刷記録媒体に関する。
【0002】
【従来の技術】再生装置によって記録データが再生されるCD、CD－ROMおよびCD－Rなどの光記録媒体において、その一方表面はデータの記録や読出しを行うデータ記録読出し面として使用され、他方表面は一般にタイトルなどを印刷する印刷表示面として使用される。
【0003】一方、紙などの基材上に感熱発色層を設けた感熱印刷シートである印刷媒体が、たとえば特開平3－43293号公報および特開平5－69566号公報に開示されている。感熱発色層はイエロー、マゼンタおよびシアンに発色する3つの発色層から成り、多色感熱印刷シートにサーマルヘッドなどを用いて熱を加えて発色させて印刷する、いわゆるTA(Thermo-Auto Chrome)方式の印刷装置を用いて印刷される。
【0004】
【発明が解決しようとする課題】光記録媒体は、再生装置に挿入された後、クランプされ、回転させながらデータ記録読出し面の側からピックアップを介してレーザ光が照射されて、記録データが再生される。このような光記録媒体に対して、再生装置への出入れや記録データの再生を安定かつ確実に行うために、厚みや反りなどに関するスペックが定められている。たとえば、厚みのスペックは1．2mmであり、反りの許容範囲は400μm以内である。したがって、印刷表示面にタイトルなどを印刷するに当たって、媒体の厚みは上記のスペックに近いことが好ましい。
【0005】また、上記印刷媒体を光記録媒体の印刷表示面に貼付け、印刷装置を用いてタイトルなどを印刷することが考えられる。このような印刷に当たり、記録データが破壊されないことが要求される。たとえばサーマルヘッドから印加される熱がデータ記録層に過剰に伝わると、記録されたデータが破壊されてしまう。また、高い印刷品質が要求される。光記録媒体が通常有する反りや厚みの違いによって、サーマルヘッドと印刷媒体との密着性が悪くなり、サーマルヘッドからの熱が印刷媒体の発色層に均一に与えられなかった場合、印刷品質が低下する。光記録媒体には、通常20μm程度の反りが生じている。
【0006】本発明の目的は、再生装置への出入れや記録データの再生が安定的にかつ確実に行え、記録データを破壊することなく高品質な印刷が可能な印刷記録媒体を提供することである。
【0007】
【課題を解決するための手段】本発明は、光反射層とデータ記録層とを有し、一方がデータ記録読出し面で、他方が印刷表示面で構成される光記録部材と、印刷表示面側に設けられ、熱によって発色する発色層とを備えることを特徴とする印刷記録媒体である。
【0008】本発明に従えば、たとえば1．2mmの比較的厚い光記録部材上に発色層が設けられて印刷記録媒体が構成される。発色層の厚さは、数μm～数十μmの極薄いものであり、印刷記録媒体の厚みは光記録部材のスペックとほぼ同じとなる。したがって、印刷記録媒体の再生装置への出入れを安定かつ確実に行うことができる。また、記録データを安定的にかつ確実に再生することができる。
【0009】また本発明は、前記光記録部材と発色層との間に、発色時に印加される熱の光記録部材への伝達を防ぐ断熱層を設けたことを特徴とする。
【0010】本発明に従えば、タイトルなどの印刷時には、サーマルヘッドなどから発色層へ熱が印加される。このとき、光記録部材と発色層との間の断熱層によって、熱が光記録部材へ伝わることが防止される。したがって、光記録部材に記録されたデータの熱による破壊を阻止することができる。
【0011】また本発明は、前記光記録部材と発色層との間に、発色時に印加される熱の発色層への伝達を均一化する弾性層を設けたことを特徴とする。
【0012】本発明に従えば、光記録部材と発色層との間の弾性層は光記録部材の反りや厚みの違いを吸収するので、タイトルなどの印刷時においてサーマルヘッドと発色層との密着性が向上する。したがって、高品位な印刷が可能となる。

【0013】また、光記録部材と発色層との間に断熱層と弾性層とをともに設けることによって、サーマルヘッドからの熱が光記録部材へ伝わることが防止できるとともにサーマルヘッドと発色層との密着性が高まり、記録データの熱による破壊を阻止しかつ高品位な印刷が可能となる。
【0014】また本発明は、光反射層とデータ記録層とを有し、一方がデータ記録読出し面で、他方が印刷表示面で構成される光記録部材と、印刷表示面側に設けられる発色部材であって、熱によって発色する発色層を基材上に有する発色部材と、光記録部材と発色部材との間に設けられ、発色時に印加される熱の光記録部材への伝達を防ぐ断熱層とを備えることを特徴とする印刷記録媒体である。
【0015】本発明に従えば、印刷時においてサーマルヘッドからの熱が光記録部材へ伝わることを防止する上述したような断熱層が、光記録部材と発色部材との間に設けられる。したがって、基材上に発色層を設けた発色部材を有する印刷記録媒体においても、記録データの熱による破壊を阻止することができる。
【0016】また本発明は、前記光記録部材と発色層との間に、前記断熱層に代わって、発色時に印加される熱の発色層への伝達を均一化する弾性層を設けたことを特徴とする。
【0017】本発明に従えば、印刷時においてサーマルヘッドと発色層との密着性を高め、たとえば光記録部材が有する反りや厚みの違いによる密着性の低下を緩和する上述したような弾性層が、光記録部材と発色部材との間に設けられる。したがって、基材上に発色層を設けた発色部材を有する印刷記録媒体においても、高品位な印刷が可能となる。
【0018】また本発明は、前記光記録部材と発色層との間に、前記断熱層に加えて、発色時に印加される熱の発色層への伝達を均一化する弾性層を設けたことを特徴とする。
【0019】本発明に従えば、光記録部材と発色部材との間に断熱層と弾性層とをともに設けることによって、サーマルヘッドから与えられる熱が光記録部材へ伝わることを防止するとともにサーマルヘッドと発色層との密着性を高めることができ、記録データの熱による破壊を阻止しかつ高品位な印刷が可能となる。
【0020】
【発明の実施の形態】図1(a)は、本発明の実施の第1形態である印刷記録媒体19aを示す断面図であり、図1(b)は、印刷記録媒体19aの感熱発色層23を詳細に示す断面図である。印刷記録媒体19aは、光記録部材20の印刷表示面20aの上に感熱発色層23を設けて構成される。
【0021】光記録部材20は、光反射層とデータ記録層とを有し、たとえばポリカーボネイトなどから成る基板30の上に、データ記録層である有機色素層25と、金属などからなる光反射層26と、紫外線硬化樹脂などから成る保護層27とを、この順番に積層して構成される。また、光記録部材20は、一方がデータ記録読出し面で、他方が印刷表示面で構成される。たとえば、基板30の側がデータ記録読出し面20bであり、保護層27の側が印刷表示面20aである。光記録部材20では、データ記録読出し面20bの側からピックアップ39を介してレーザ光を照射することによって、有機色素層25を相変化させてデータの記録を行い、またデータを読取る。
【0022】このような光記録部材20は、たとえば片面からデータの記録および読出しを行う円盤状のCD、CD－ROM、CD－RおよびCD－RW(ReWritable)などの光ディスクで実現される。また、DVD(Digital Video Disk)－ROM、DVD－RAM(Random Access Memory)、DVD－RおよびDVD－RWなどの光ディスクでも実現可能である。これらの光ディスクに対する厚みのスペックは、1．2mmである。また、反りの許容範囲は400μm以内である。
【0023】感熱発色層23は、イエロー、マゼンタおよびシアンに発色する3つの発色層23a，23b，23cから成る。このような感熱発色層23は、特開平3－43293号公報や特開平5－69566号公報などに開示されたTA方式で印刷可能である。各発色層23a，23b，23cの厚みは数μmである。
【0024】イエロー発色層23aは、マイクロカプセルに封入されたイエロー色素材料と、カプラーとを含んで構成され、20mJ／mm^2 以上の熱エネルギの印加によって、イエロー色素材料およびカプラーがマイクロカプセルを透過するようになり、両者が反応して発色する。また、イエロー発色層23aは、波長420nmの光照射によって、未反応のイエロー色素材料が分解されてそれ以上発色しなくなり、定着される。
【0025】マゼンタ発色層23bは、マイクロカプセルに封入されたマゼンタ色素材料と、カプラーとを含んで構成され、40mJ／mm^2 以上の熱エネルギの印加によって、マゼンタ色素材料およびカプラーがマイクロカプセルを透過するようになり、両者が反応して発色する。また、マゼンタ発色層23bは、波長365nmの光照射によって、未反応のマゼンタ色素材料が分解されてそれ以上発

色しなくなり、定着される。
【0026】シアン発色層23cは、マイクロカプセルに封入されたシアン色素材料と、カプラーとを含んで構成され、80mJ／mm^2 以上の熱エネルギの印加によって、シアン色素材料およびカプラーがマイクロカプセルを透過するようになり、両者が反応して発色する。
【0027】図2は、タイトルなどの印刷時に用いられる回転印刷装置10の概略的構成を示す斜視図である。回転印刷装置10は、大別して、サーマルヘッド11、バックアップローラ12および陰極管13，14を備え、円盤状の印刷記録媒体Mに対して印刷を行う。ここで印刷記録媒体Mは具体的に前記印刷記録媒体19aで実現される。
【0028】サーマルヘッド11は、印刷記録媒体Mの半径方向に延びるライン式のサーマルヘッドであり、ばね16によって印刷記録媒体Mをその表面から押圧する。ステッピングモータ15は、印刷記録媒体Mをその軸回りに回転駆動する。バックアップローラ12は、その表面がゴムで覆われ、サーマルヘッド11による表面からの押圧に対して、印刷記録媒体Mを裏面から支持するローラであり、印刷記録媒体Mの回転に伴って回転する。陰極管13，14は、印刷記録媒体Mの発色層を定着させる波長の光を発する。
【0029】このような回転印刷装置10は、印刷記録媒体Mの半径方向を主走査方向とし、印刷記録媒体Mの円周方向を副走査方向として、印刷記録媒体Mの半径方向および円周方向に配列する画素領域に対して、選択的に熱を供給して発色させ、所定の波長光を照射して定着させることによって、印刷を行う。
【0030】なお、サーマルヘッド11に代えて印刷記録媒体Mの半径方向に沿って走査可能なシリアルヘッドを用いることもでき、またバックアップローラ12に代えてターンテーブルを用いることもできる。
【0031】記録データの再生時には、印刷記録媒体Mが再生装置に挿入され、クランプされ、回転させながらデータ記録読出し面20bの側からピックアップ39を介してレーザ光が照射されて、記録データが再生される。
【0032】図1に示す第1形態の印刷記録媒体19aは、比較的厚い光記録部材20の上に極薄い感熱発色層23を設けたものであり、印刷記録媒体19aの厚みは光記録部材20の厚みとほぼ同じである。したがって、再生装置への印刷記録媒体19aの出入れが安定的にかつ確実に行える。また、記録データを安定的にかつ確実に再生することができる。さらに、回転印刷装置10への印刷記録媒体19aの出入れも安定的にかつ確実に行うことができて、印刷を安定かつ確実に行うことができる。
【0033】図3(a)は、本発明の実施の第2形態である印刷記録媒体19bを示す断面図である。印刷記録媒体19bは、第1形態の印刷記録媒体19aと同様の光記録部材20および感熱発色層23に加えて、光記録部材20と感熱発色層23との間に設けられる断熱層28bを有する。印刷記録媒体19bは、たとえば光記録部材20の上に断熱層28bを設けた後、感熱発色層23を設けることによって作成される。
【0034】図3(b)は、本発明の実施の第2形態の他の例である印刷記録媒体19cを示す断面図である。印刷記録媒体19cは、第1形態の印刷記録媒体19aと同様の光記録部材20と、感熱発色層23に代わって設けられる発色部材21と、光記録部材20と発色部材21との間に設けられる断熱層28cとを備える。発色部材21は、紙などの遮光性の基材22の上に、イエロー、マゼンタおよびシアンに発色する3つの発色層23a，23b，23cから成る前記感熱発色層23を有し、感熱発色層23とは反対側の基材22の表面が接着層24を介して光記録部材20の印刷表示面20aの上の断熱層28cと接着される。
【0035】たとえば、印刷記録媒体19cは光記録部材20の印刷表示面20aの上に断熱層28cを設ける一方、発色部材を準備する。ここで、準備する前記発色部材とは、基材22の一方表面に感熱発色層23を設け、感熱発色層23とは反対側の他方表面に接着層24を設け、接着層24の上に離型紙を貼合わせたものである。このような発色部材から離型紙を剥がし、露出した接着層24と光記録部材20の上に設けられた断熱層28cとを貼合わせることによって、印刷記録媒体19cが作成される。
【0036】またあるいは、印刷記録媒体19cは光記録部材20の印刷表示面20aの上に断熱層28cを設け、その上に接着層24を設けて基材22を貼合わせ、さらにその上に感熱発色層23を設けることによって、作成される。ここで、接着性を有する断熱層28cを設ける場合、接着層24は不要である。
【0037】さらにあるいは、印刷記録媒体19cは光記録部材20の印刷表示面20aの上に断熱層28cを設け、さらに接着層24を設ける一方、発色部材を準備する。ここで、準備する前記発色部材

とは、基材22の一方表面に感熱発色層23を設けたものである。このような発色部材の基材22と断熱層28cの上の接着層24とを貼合わせることによって、印刷記録媒体19cが作成される。ここで、接着性を有する断熱層28cを設ける場合、接着層24は不要である。

【0038】図4は、印刷記録媒体19b, 19cの断熱作用を説明するための断面図である。印刷時には、サーマルヘッド11が印刷記録媒体19b, 19cに当接し、該サーマルヘッド11からの熱が媒体19b, 19cの感熱発色層23、発色部材21に与えられる。熱は高温部から低温部へ伝わるので、感熱発色層23、発色部材21からさらに光記録部材20に伝わるが、第2形態の印刷記録媒体19b, 19cには断熱層28b, 28cが設けられるので、該断熱層28b, 28cによって光記録部材20に伝わる熱量が少なくなる。したがって、光記録部材20に記録されたデータの熱による破壊を防止することができる。

【0039】たとえば、印刷装置を用いて光記録部材20に直接印刷を行った場合、下記の印刷条件では記録データが破壊した。このときのヘッド温度は200℃～250℃程度である。

【0040】(記録データ破壊時の印刷条件)
ヘッド電圧:16Vヘッド通電エネルギーの制御:1ドット毎のオン／オフの繰返し回数による階調制御(繰返しの最大回数は250回)、図5に示されるバイアス通電時間T1は1500us、通電オフ時間T2は24us、通電オン時間T3は40usヘッド通電繰返し回数:100回印加時間:50ライン弱ヘッド抵抗値:1250Ωヘッドでの消費電力量:0. 204W1ドットのエネルギー量:0. 978mJ(通電100回繰返し)
上記条件での最大濃度時の通電繰返し回数は200回程度であり、100ラインを連続で印加したときのヘッド温度は約300℃となる。このとき、1ドットのエネルギー量は1. 711mJ(通電200回繰返し)となる。したがって、記録データ破壊時の温度と最大のヘッド印加温度との間には50℃～100℃の開きがあることとなり、断熱層が必要であることが判る。

【0041】この50℃～100℃の温度差を断熱層28b, 28cによって全て吸収するとすれば、たとえば熱伝導率が0. 17～0. 25($W \cdot M^{-1} \cdot K^{-1}$)のアクリル樹脂を断熱層28b, 28cとして使用した場合は、その膜厚は0. 14mm以上必要となる。また熱伝導率が0. 1～0. 2($W \cdot M^{-1} \cdot K^{-1}$)のゴムを使用した場合には、その膜厚は0. 11mm以上必要となる。実際には、感熱発色層23、発色部材21などによって熱が吸収されて放出されることをも考慮して、断熱層28b, 28cの膜厚が決定される。このため、前記の膜厚よりも薄く設定することが可能となる。このような断熱層28b, 28cは、たとえばアクリル系接着剤、ゴムおよび発泡性の基材の両面に接着層を設けた発泡性両面テープなどで実現される。

【0042】図6(a)は、本発明の実施の第3形態である印刷記録媒体19dを示す断面図である。印刷記録媒体19dは、第2形態の印刷記録媒体19bとほぼ同様に構成されるが、光記録部材20と感熱発色層23との間に断熱層28bに代わって弾性層29dを有する。印刷記録媒体19dは、たとえば光記録部材20の上に弾性層29dを設けた後、感熱発色層23を設けることによって、作成される。

【0043】図6(b)は、本発明の実施の第3形態の他の例である印刷記録媒体19eを示す断面図である。印刷記録媒体19eは、第2形態の印刷記録媒体19cとほぼ同様に構成されるが、光記録部材20と発色部材21との間に断熱層28cに代わって弾性層29eを有する。

【0044】たとえば、印刷記録媒体19eは光記録部材20の印刷表示面20aの上に弾性層29eを設ける一方、第2形態の他の例と同様の発色部材を準備し、発色部材の離型紙を剥がして露出した接着層24と光記録部材20の上に設けられた弾性層29eとを貼合わせることによって、作成される。

【0045】またあるいは、印刷記録媒体19eは光記録部材20の印刷表示面20aの上に弾性層29eを設け、その上に接着層24を設けて基材22を貼合わせ、さらにその上に感熱発色層23を設けることによって、作成される。ここで、接着性を有する弾性層29eを設ける場合、接着層24は不要である。

【0046】さらにあるいは、印刷記録媒体19eは光記録部材20の印刷表示面20aの上に弾性層29eを設け、さらに接着層24を設ける一方、第2形態の他の例と同様の発色部材を準備し、発色部材の基材22と弾性層29eの上の接着層24とを貼合わせることによって作成される。ここで、接着性を有する弾性層29eを設ける場合、接着層24は不要である。

【0047】図7は、印刷記録媒体19d, 19eの弾性作用を説明するための図である。図7(a)は印刷記録媒体19d, 19eを一部分を切欠いて示す平面図であり、図7(b)は図7(a)のI－I断面図であり、図7(c)は図7(a)のII－II断面図である。印刷時には、サーマルヘッド11が印刷記録媒体1

9d, 19eに当接する。通常、光記録部材20には反りが生じているが、第3形態の印刷記録媒体19d, 19eには弾性層29d, 29 が設けられているので、前記反りが弾性層29d, 29 によって吸収される。したがって、反りによるサーマルヘッド11と印刷記録媒体19d, 19eとの密着性の低下が防止できる。また、たとえば光記録部材20の内周と外周とでその厚みにばらつきが生じる場合があるが、前記弾性層29d, 29eによってその厚みの違いが吸収される。したがって、厚みの違いによる密着性の低下が防止できる。これによって、高品位な印刷が可能となる。

【0048】光記録部材20に20μmの反り等が生じている場合に、弾性層29d, 29eの弾性のみによって印刷記録媒体19d, 19eの全周にわたりサーマルヘッド11を密着させるには、サーマルヘッド11からの印刷記録媒体19d, 19eに対する押圧力を1. 2kgとし、当接面積を20mm^{2}とし、弾性層29d, 29eの材料として用いるゴムの弾性係数を10～30kgf／cm^{2}とすると、弾性層29d, 29eは0. 1mm以上の厚みが必要となる。実際には感熱発色層23、発色部材21などの弾性をも考慮して弾性層29d, 29eの膜厚が決定されるので、前記の膜厚よりも薄く設定することができる。このような弾性層29d, 29eは、たとえばアクリル系接着剤、ゴムおよび発泡性の基材の両面に接着層を設けた発泡性両面テープなどで実現される。

【0049】図8(a)は、本発明の実施の第4形態である印刷記録媒体19fを示す断面図である。印刷記録媒体19fは、光記録部材20と感熱発色層23との間に断熱層28fと弾性層29fとをともに設けたものである。印刷記録媒体19fは、たとえば光記録部材20の上に断熱層28fを設け、さらにその上に弾性層29fを設けた後、感熱発色層23を設けることによって、作成される。なお、弾性層29fおよび断熱層28fを逆に設けても構わない。

【0050】図8(b)は、本発明の実施の第4形態の他の例である印刷記録媒体19gを示す断面図である。印刷記録媒体19gは、光記録部材20と発色部材21との間に断熱層28gと弾性層29gとをともに設けたものである。

【0051】たとえば、印刷記録媒体19gは、光記録部材20の印刷表示面20aの上に断熱層28gを設け、さらにその上に弾性層29gを設ける一方、第2形態の他の例と同様の発色部材を準備し、発色部材の離型紙を剥がして露出した接着層24と光記録部材20の上の弾性層29gとを貼合わせることによって、作成される。なお、断熱層28gおよび弾性層29gを逆に設けても構わない。

【0052】またあるいは、印刷記録媒体19gは光記録部材20の印刷表示面20aの上に断熱層28gおよび弾性層29gをこの順番に設け、弾性層29gの上に接着層24を設けて基材22を貼合わせ、さらにその上に感熱発色層23を設けることによって、作成される。なお、断熱層28gおよび弾性層29gを逆に設けても構わない。また、基材22側の断熱層28gまたは弾性層29gが接着性を有する場合、接着層24は不要である。

【0053】さらにあるいは、印刷記録媒体19gは光記録部材20の印刷表示面20aの上に断熱層28gおよび弾性層29gをこの順番に設け、さらに接着層24を設ける一方、第2形態の他の例と同様の発色部材を準備し、発色部材の基材22と弾性層29gの上の接着層24とを貼合わせることによって、作成される。なお、断熱層28gおよび弾性層29gを逆に設けても構わない。また、基材22側の断熱層28gまたは弾性層29gが接着性を有する場合、接着層24は不要である。

【0054】第4形態の印刷記録媒体19f, 19gでは、断熱層28f, 28gによって印刷時に光記録部材20に伝わる熱を少なくすることができるとともに、弾性層29f, 29gによって光記録部材20の反りや厚みの違いによるサーマルヘッド11の密着性の低下を防止することができる。したがって、光記録部材20に記録されたデータの熱による破壊を防止するとともに、高品位な印刷が可能となる。

【0055】印刷記録媒体19f, 19gに関して、断熱層28f, 28gは前記断熱層28b, 28cと同様に構成され、また弾性層29f, 29gは前記弾性層29d, 29eと同様に構成される。

【0056】

【発明の効果】以上のように本発明によれば、比較的厚い光記録部材上に極薄い発色層を設けて印刷記録媒体を構成したので、印刷記録媒体の厚みは光記録部材のスペックとほぼ同じとなり、印刷記録媒体の再生装置への出入れおよび記録データの再生を安定的にかつ確実に行うことができる。

【0057】また本発明によれば、タイトルなどの印刷時にサーマルヘッドなどから発せられた熱が光記録部材へ伝わることを断熱層によって防止することができ、したがって光記録部材に記録されたデータの熱による破壊を阻止することができる。

【0058】また本発明によれば、弾性層によって印刷時にサーマルヘッドと発色層との密着性が高

められるので、光記録部材の反りや厚みの違いなどによる密着性の低下を緩和でき、高品位な印刷が可能となる。また、断熱層と弾性層とをともに設けることによって、サーマルヘッドなどからの熱が光記録部材へ伝わることが防止できるとともにサーマルヘッドと発色層との密着性が高まり、記録データの熱による破壊を阻止しかつ高品位な印刷が可能となる。

【0059】また本発明によれば、光記録部材と発色部材との間の断熱層によって、サーマルヘッドなどからの熱が光記録部材へ伝わることが防止できる。

【0060】また本発明によれば、光記録部材と発色部材との間の弾性層によって、サーマルヘッドと発色層との密着性を高めることができる。

【0061】また本発明によれば、光記録部材と発色部材との間の断熱層および弾性層によって、サーマルヘッドなどからの熱が光記録部材へ伝わることが防止できるとともに、サーマルヘッドと発色層との密着性を高めることができる。

図の説明

【図面の簡単な説明】

【図1】図1(a)は、本発明の実施の第1形態である印刷記録媒体19aを示す断面図であり、図1(b)は、印刷記録媒体19aの感熱発色層23を詳細に示す断面図である。

【図2】回転印刷装置10の概略的構成を示す斜視図である。

【図3】図3(a)は、本発明の実施の第2形態である印刷記録媒体19bを示す断面図であり、図3(b)は、本発明の実施の第2形態の他の例である印刷記録媒体19cを示す断面図である。

【図4】印刷記録媒体19b, 19cの断熱作用を説明するための断面図である。

【図5】バイアス通電時間T1、通電オフ時間T2および通電オン時間T3を示すタイミングチャートである。

【図6】図6(a)は、本発明の実施の第3形態である印刷記録媒体19dを示す断面図であり、図6(b)は、本発明の実施の第3形態の他の例である印刷記録媒体19eを示す断面図である。

【図7】印刷記録媒体19d, 19eの弾性作用を説明するための図である。

【図8】図8(a)は、本発明の実施の第4形態である印刷記録媒体19fを示す断面図であり、図8(b)は、本発明の実施の第4形態の他の例である印刷記録媒体19gを示す断面図である。

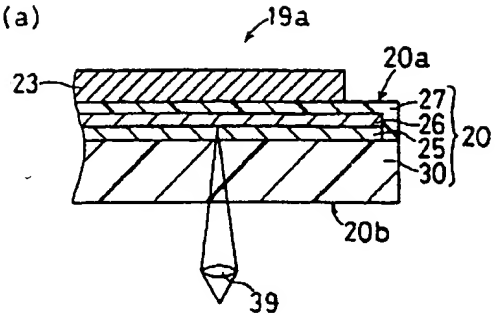
【符号の説明】

19a～19g 印刷記録媒体
20 光記録部材
20a 印刷表示面
20b データ記録読出し面
21 発色部材
22 基材
23 感熱発色層
23a イエロー発色層
23b マゼンタ発色層
23c シアン発色層
24 接着層
25 有機色素層
26 光反射層
28b, 28c, 28f, 28g 断熱層
29d, 29e, 29f, 29g 弾性層
M 円盤印刷記録媒体

図面

【図1】

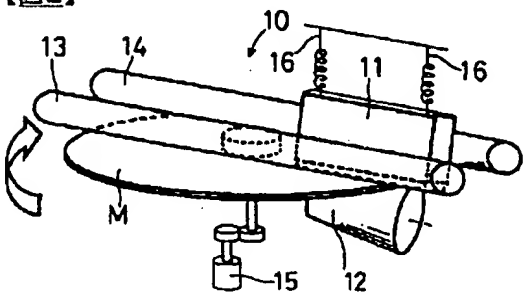
(a)


19a
20a
23
27
26
25
30
20
20b
39

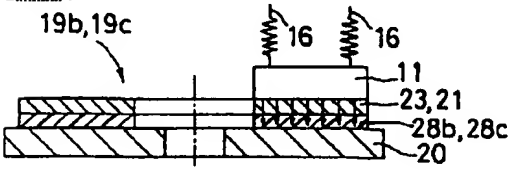
(b)


23a
23b
23c
23

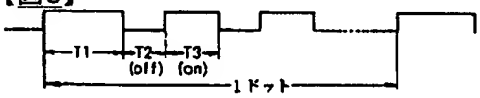
【図2】


10
13
14
16
11
16
M
15
12

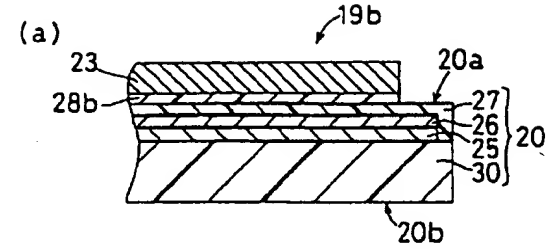
【図4】

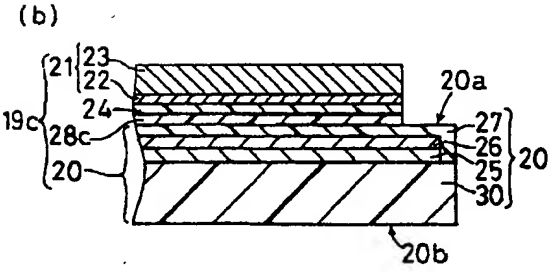

19b,19c
16
16
11
23,21
28b,28c
20

【図5】

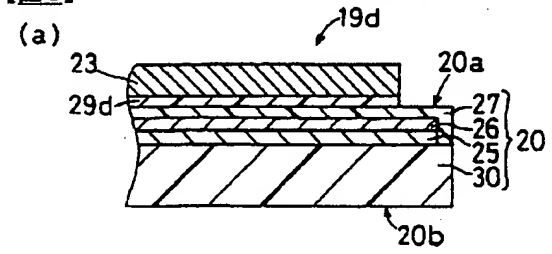

T1
T2
(off)
T3
(on)
1ドット

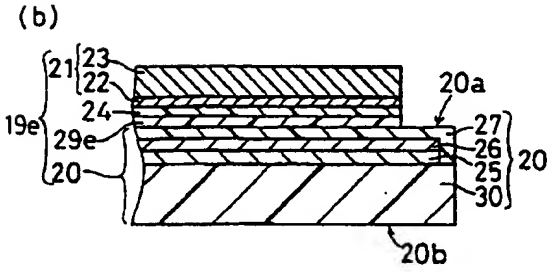
【図3】


(a)
19b
23
20a
28b
27
26
25
20
30
20b


(b)
21
23
22
20a
24
19c
27
28c
26
20
25
30
20b

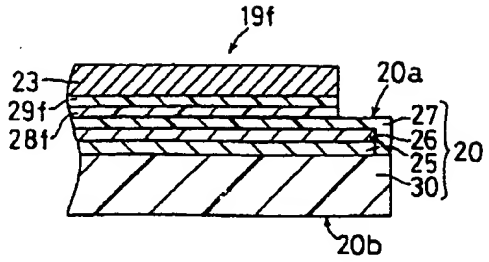
【図6】


(a)
19d
23
20a
29d
27
26
25
20
30
20b

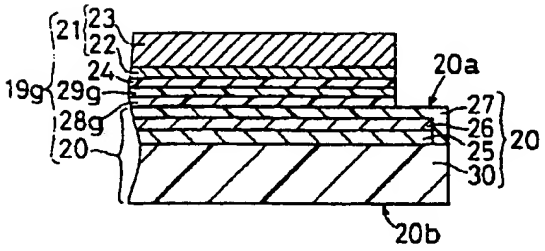

(b)
21
23
22
20a
24
19e
27
29e
26
20
25
30
20b

【図8】

(a)

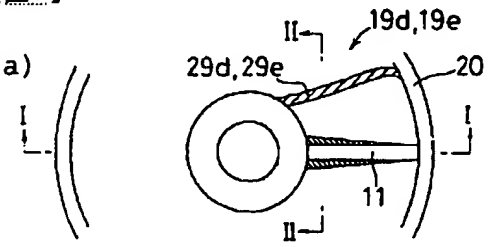

19f
23
29f
28f
20a
27
26
25
30
20
20b

(b)

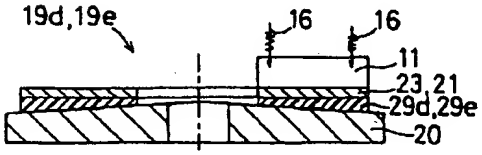

21
23
22
24
19g
29g
28g
20
20a
27
26
25
30
20
20b

【図7】

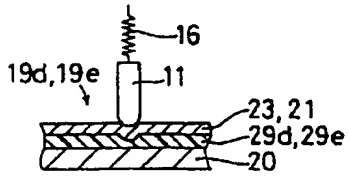
(a)


II
19d,19e
29d,29e
20
I
I
11
II

(b)


19d,19e
16
16
11
23,21
29d,29e
20

(c)


16
19d,19e
11
23,21
29d,29e
20

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(71) Applicant: 000107642
Star Micronics Co., Ltd.
Shizuoka-ken, Shizuoka-shi, Naka Yoshida, 2-ban, 10-go

(72) Inventor: Norihiro SAWAMOTO
c/o Star Micronics Co., Ltd.
Shizuoka-ken, Shizuoka-shi, Naka Yoshida, 2-ban, 10-go

(72) Inventor: Kenichi NAGAI
c/o Star Micronics Co., Ltd.
Shizuoka-ken, Shizuoka-shi, Naka Yoshida, 2-ban, 10-go

(72) Inventor: Yasunori TSUKUDA
c/o Star Micronics Co., Ltd.
Shizuoka-ken, Shizuoka-shi, Naka Yoshida, 2-ban, 10-go

(72) Inventor: Katsuyuki KATAYAMA
c/o Star Micronics Co., Ltd.
Shizuoka-ken, Shizuoka-shi, Naka Yoshida, 2-ban, 10-go

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5D029 MA28 PA01

(57) Summary

(Task)

High-quality printing is conducted in a stable and secure manner without damaging the recording data by loading and unloading data in a stable and secure manner to and from a playback device and reproducing the recorded data.

(Solution Means)

Because a print recording medium 19a is provided with a very thin thermosensitive color development layer 23 deployed on top of a relatively thick optical recording member 20, so that its thickness is approximately identical to specifications for the optical recording member 20, the medium 19a can be loaded to and removed from a playback device and recorded data can be regenerated safely and with reliability. In addition, because a heat insulation layer is used between an optical recording member 20 and a thermosensitive color development layer 23 or a color development member, transfer of heat generated during printing to the optical recording member 20 can thus be prevented, which prevent the data recorded on the optical recording member 20 from being destroyed by the heat. In addition, an elastic layer is employed between the optical recording member 20 and thermosensitive color development layer 23 or the color development member, adhesiveness of the thermal head is increased, and reduced adhesiveness which can be cause by warpage or a differing thickness of the optical recording member 20 is thus compensated for, enabling a high quality of the print product.

[Figure (a) and (b)

(Scope of the Patent's Claims)

(Claim 1)

A print recording medium, characterized by the fact that it is equipped with an optical recording member construction having an optical reflection layer and a data recording layer for recording and reading of data on one surface and for displaying of print on another surface;

and with a color development layer for thermal development of color, deployed on the side of the print display surface.

(Claim 2)

The print recording medium described in claim 1, characterized by the fact that a heat

insulation layer is employed between said optical recording member and color development layer to prevent heat generated during printing from being transferred to the optical recording member.

(Claim 3)

The print recording medium described in claim 1 or claim 2, characterized by the fact that an elastic layer is employed between said optical recording member and color development layer to create uniform transfer of the heat generated during color development to the color development layer.

(Claim 4)

A print recording medium, characterized by the fact that it is equipped with an optical recording member having an optical reflection layer and a data recording layer, with a construction enabling data recording and reading on one surface, and print displaying on another surface;

as well as with a color development layer having on a base material a color development layer for thermal color development, as a color development member deployed on the side of the print display surface;

and with a heat insulation layer preventing heat generating during color development from being transferred to the optical recording member.

(Claim 5)

The print recording medium described in claim 4, characterized by the fact that an elastic layer is employed instead of said heat insulation layer between said optical recording member and color development layer to induce uniform transfer of the heat applied during color development to the color development layer.

(Claim 6)

The print recording medium described in claim 4, characterized by the fact that an elastic layer is employed in addition to said heat insulation layer between said optical recording member and color development layer to induce uniform transfer of the heat applied during color development to the color development layer.

(Detailed Explanation of the Invention)

(0001)

(Sphere of Technology Belonging to the Invention)

This invention relates to an optical recording member such as a CD (Compact Disk), CD-ROM (Read Only Memory) and CD-R (Recordable), etc., and to a print recording medium equipped with a color development layer enabling thermal color development.

(0002)

(Prior Art Technology)

In optical recording media such as CDs used for recording of data and playback in playback devices, or CD-ROM or CD-R media and similar optical recording media, one of the surfaces is used as a surface for recording of data or a surface for reading and reading and recording of data, while the other surface is used as a printed display surface that displays for example the title.

(0003)

On the one hand, print medium using a thermosensitive print sheet wherein a thermosensitive color development layer is created on a base material such as paper or the like was disclosed for example in Unexamined (Kokai) Japanese Patent Application Number 3-43293 and Unexamined (Kokai) Japanese Patent Application Number 5-69566. The thermosensitive color development layer consists of 3 color development layers used to develop yellow, magenta and cyan color, and color printing is achieved when heat is applied by using a thermal head or the like to a multicolor thermosensitive print sheet.

(0004)

(Problems To Be Solved By This Invention)

After an optical recording medium has been inserted in a playback device, while the medium is clamped and rotated, it is irradiated with laser light via a pickup from the side of the data recording and reading surface, which makes it possible to reproduce recorded data. In order to input and output data to and from a playback device reliably and safely with this type of optical recording medium, a specified thickness, warpage and other determined specifications must be used. For example, the specified thickness is 1.2 mm, the allowable warpage range is within 400 μm. Accordingly, it is desirable when the thickness of the medium is close to the thickness of the specifications to allow printing of the title and the like on the printed surface.

(0005)

In addition, a printed indication of the optical recording medium is affixed to said recording medium to provide information about the recording by using a printing device for printing of a title, etc. A requirement on this type of printing is that it should not damage the recorded data. Recorded data can be damaged for example when excessive heat is applied to a data recording layer from a thermal head as this can result in damage to the recorded data. In

addition, a high quality of printing is required. If the warpage or thickness is different from common specifications used for a recording medium, this may result in poor adhesion of the thermal head to the optical recording medium and if the heat transferred from the thermal head is not distributed uniformly in the color development layer of the print recording medium, this will reduce the printing quality. Warpage corresponding to approximately 20 μm will be generated in a common type of an optical recording medium.

(0006)

The purpose of this invention is to provide a print recording medium, wherein high-quality printing can be conducted in a stable and secure manner without damaging the recording data by loading and unloading data in a stable and secure manner to and from a playback device and reproducing the recorded data.

(0007)

(Means To Solve Problems)

The present invention is a print recording medium, characterized by the fact that it is equipped with an optical recording member, constructed with an optical reflection layer and a data recording layer, wherein data recording and reading is performed on one surface, while the other surface is used for print display; and with a color development layer wherein color is developed by heat.

(0008)

According to this invention, a print recording medium is created with a construction in which a color development layer is deployed on a relatively thick optical recording member, having a thickness of for example 1.2 mm. The thickness of the color developing layer is relatively thin, in the range from several μm ~ several tens of μm, approximately the same as according to the specifications for thickness of an optical recording member of a print recording medium. Input to and output from the medium can be performed from playback devices for print recording medium safely and reliably. In addition, the data can be also recorded and played safely and reliably.

(0009)

The invention is also characterized by the fact that a heat insulation layer is employed between said optical recording member and color development layer to prevent transfer of heat to the optical recording member when printing is conducted during color development.

(0010)

In accordance with this invention, printing is conducted with heat applied from a thermal

head to a color development layer during the printing of the title and the like. At this point, transfer of heat to the optical recording member is prevented by a heat insulation layer deployed between the optical recording member and the color development layer. Accordingly, this makes it possible to prevent damaging of the data that is recorded on the optical recording member by the heat.

(0011)

This invention is also characterized by the fact that an elastic layer is created between said optical recording member and color development layer transferring heat applied during color development to the color development layer.

(0012)

Because the elastic layer deployed according to this invention between an optical recording member and a color development layer absorbs warpage and thickness differences of the optical recording member, this improves adhesion of the thermal head to the color development layer during printing of a title or the like. Accordingly, printing can be achieved with a high product quality.

(0013)

In addition, because a heat insulation layer is deployed with an elastic layer between an optical recording member and a color development layer, this makes it possible to prevent heat from being transferred from the thermal head to the optical recording member. At the same time, the adhesion between the thermal head and the color development layer is increased, enabling a high product quality of the print while destruction of data by heat is prevented.

(0014)

Further, this invention relates to a print recording medium characterized by the fact that it is equipped with an optical recording member having a construction comprising an optical reflection layer and a data recording layer, wherein data recording and reading is performed on one surface, while display printing is conducted on the other surface;

a color development member having a color development layer on a base material enabling coloring with heat, as a color development member that is deployed on the side of the print display surface;

and a heat insulation layer preventing heat applied during color development from being transferred to the optical recording member, deployed between the optical recording member and color development member.

(0015)

According to this invention, a heat insulation layer is deployed between the optical recording member and the color development member as described above in order to prevent transfer of heat from the thermal head to the optical recording member during printing. Accordingly, this makes it possible to prevent the recording data from being damaged by the heat in a print recording medium having a color development member deployed with a color development layer on a base substance.

(0016)

Further, this invention is characterized by the fact that an elastic layer is created for a uniform transfer of the heat applied during color development to the color development layer instead of said heat insulation layer deployed between said optical recording member and color development layer.

(0017)

Also, according to this invention, adhesion between the color development layer and the thermal head is increased during printing with an elastic member as mentioned above, which compensates for reduced elasticity that can be caused for instance by a different thickness or warpage of the optical recording member. This elastic layer is deployed between the optical recording member and the color development member. Accordingly, this enables a high product quality in a print recording medium having a color development part with a color development layer on a base material.

(0018)

This invention is also characterized by having in addition to said heat insulation layer, which is created between said optical recording member and color development layer, also an elastic layer, enabling a uniform transfer of heat generated during color development to the color development layer.

(0019)

Because in accordance with this invention, a heat insulation layer is deployed with an elastic layer between an optical recording member and a color development member, this prevents the heat transferred from the thermal head from being transferred to the optical recording member, while adhesion of the thermal head to the color development layer can be increased at the same time, enabling to attain a high product quality while preventing destruction of the recording data by heat.

(0020)

(Embodiment Mode of This Invention)

Figure 1 (a) shows a cross-sectional view of a print recording medium 19a in Embodiment 1 of the present invention. Figure 1 (b) is a cross-sectional diagram showing in detail a thermosensitive color development layer 23 of the print recording medium 19a of Figure 1. The print recording medium 19a has a construction wherein the thermosensitive color development layer 23 is deployed on top of a print display surface 20a of an optical recording member 20.

(0021)

The construction of the optical recording member 20, having an optical reflection layer and a data recording, is provided on top of a substrate 30, which can be made for example from polycarbonate or the like, with an organic pigment layer 25, which is a data recording layer, and a protective layer 27 made of ultraviolet ray setting resin or the like, wherein the laminated construction is formed in this order. In addition, the optical recording member 20 is constructed with a data recording and reading surface on one side, and with a print display surface on the other side. For example, the data recording and reading surface 20b is deployed on the side of the substrate 30, and the print display surface 20 is deployed on the side of the protective layer 27. When irradiation with laser rays is applied via pickup 39 from the side of the data recording and reading surface 20b with the optical recording member 20, this will cause a phase change of the organic pigment layer 25 and recording and reading of data will be performed.

(0022)

This type of an optical recording member 20 makes it possible to realize an optical disk such as a disk-shaped CD for recording and reading of data for example from a single surface, or a CD-ROM, CD-R and CD-RW (ReWritable) optical disk or the like. In addition, DVD (Digital Video Disk)-ROM, DVD-RAM (Random Access Memory), DVD-R and DVD-RW and other types of optical disks can be also realized. The specification thickness of such optical disks is 1.2 mm and the allowable range for warpage is within 400 μm.

(0023)

The construction of the thermosensitive color development layer 23 comprises 2 color development layers 23a, 23b, and 23c for yellow, magenta, and cyan color development. Printing can be applied to this type of thermosensitive color development layer 23 for example with the method disclosed in Unexamined (Kokai) Japanese Patent Publication Number 3-43293, or Unexamined (Kokai) Japanese Patent Application Number 5-69566 or a similar TA method. The thickness of each color development layer 23a, 23b, 23c is several μm.

(0024)

The yellow color development layer 23a is formed with a structure containing a yellow pigment material and a coupler in microcapsules, so that when heat energy exceeding 20 mJ/mm^2 is applied, it will be transmitted through the microcapsules containing the yellow pigment material and the coupler, both items will react and color development will be caused. In addition, when the yellow color development layer 23a is irradiated with light irradiation with a wavelength of 420 nm, and unreacted yellow pigment will be decomposed without causing additional coloring, enabling fixing of the color.

(0025)

The construction of the magenta color development layer 23b includes a magenta pigment material sealed in microcapsules and a coupler, so that when heat energy is applied exceeding 40 mJ/mm^2, it will pass through the microcapsules containing the magenta pigment material and the coupler, both items will react and color development will be caused. In addition, when the magenta color development layer is irradiated with light having a wavelength of 365 nm, unreacted magenta coloring material will be decomposed without causing additional coloring, enabling fixing of the color.

(0026)

The construction of the cyan color development layer 23c includes a cyan pigment material sealed in microcapsules, containing also a coupler, so that when irradiation is applied with heat energy exceeding 80 mJ/mm^2, it will pass through the cyan pigment material and the coupler and both items will react.

(0027)

Figure 2 is a perspective drawing showing a simplified construction of a rotary print device used during printing of a title, etc. The main equipment of the rotary print device include a thermal head 11, a backup roller 12 and cathode tubes 13 and 14, performing printing on a disk-shaped print recording medium M. In this case, the print recording medium M is realized specifically with said print recording medium 19a.

(0028)

The thermal head 11 is the line type of thermal head, extended in the radial direction of the print recording medium M so that pressure is applied from the surface to the print recording medium M with a spring 16. A stepping motor 15 drives and rotates the print recording medium M around its rotational axis. A backup roller 12 is rotated together with the rotations of the print recording medium M so that the roller provides support from the back surface for the print recording medium M when pressure is applied by thermal head 11 from the surface. Cathode tubes 13, 14 emit light with a wavelength enabling fixing of the color development layer on the

print recording medium M.

(0029)

Printing is performed with this type of rotary print device 10 with the main scan direction in the radial direction of the print recording device M, while the auxiliary scan direction is in the circumferential direction of the print recording medium M, to the image area arranged in the radial direction and the circumferential direction of the print recording medium M. Color development is caused selectively with supplied head by irradiation with light having a specified wavelength, followed by fixing.

(0030)

In addition, it is also possible to use a serial head enabling scanning in the radial direction of the print recording medium instead of the thermal head 11. It is further also possible to use a turntable instead of the backup roller 12.

(0031)

During playback of recorded data, a print recording medium is inserted into a playback device, and while the medium is clamped and rotated, irradiation with laser rays is applied via the pickup 39 from the side of the data recording and reading surface 20b, and the recorded data is reproduced.

(0032)

On the print recording medium 19a in Embodiment 1 which is shown in Figure 1 is deployed a very thin thermosensitive color development layer 23 on top of a relatively thick optical recording member 20, while the thickness of the optical recording member 20 is about the same as the thickness of the print recording medium 19a. Accordingly, the print recording medium 19a can be loaded to and removed from the playback device safely and reliably. Also, recording data can be reproduced with reliability in this manner. In addition, loading and unloading of the print recording medium to the rotary print device 10 can be also done safely and reliably, enabling to perform printing safely and with reliability.

(0033)

Figure 3 (a) is a drawing showing a cross-sectional view of Embodiment 2 of the print recording device of this invention, while Figure 3 (b) shows a cross-sectional view of the print recording medium 19b. The print recording medium 19b includes in addition to a print recording medium 19a, and an optical recording member 20 and thermosensitive color development layer 23, identical to Embodiment 1, also a heat insulation layer 28b deployed between the optical recording member 20 and the thermosensitive layer 23. The construction of the print recording

medium 19b comprises a thermosensitive color development layer 23, mounted after the mounting of the heat insulation layer 28b for example on top of the optical recording member 20.

(0034)

Figure 2 (B) shows a cross-sectional view of the print recording medium 19c in another example of Embodiment 2 of the present invention. The print recording medium 19c is equipped with an optical recording member 20 which is identical to the print recording medium 19a of Embodiment 1, with a color development member 21 used instead of the thermosensitive color development layer 23, and a heat insulation layer 28c deployed between the optical recording member 20 and the color development member 21. The color development member 21 has on a substrate that is provided with light shielding characteristics, for example paper, the construction of said thermosensitive color development layer 23 including 2 color development layer 23a, 23b, 23c for yellow, magenta and cyan. The surface of the substrate 22 on the reflection side of the thermosensitive color development layer 23 is adhered via adhesive layer 24 to the heat insulation layer 28c on top of the print display surface 20a of the optical recording member 20.

(0035)

The color development member is prepared, for example, when the print recording medium 19c has the head insulation layer 28c above the print display surface 20a of the optical recording member 20. In this case, this prepared color development member has a thermosensitive color development layer 23 on one surface of the base material 22, the thermosensitive color development layer 23 has an adhesive layer 24 created on the other surface on the reflection side, a separating paper is affixed on top of the adhesive layer 24. This separating paper is peeled off from the color development member, affixed to the heat insulation layer created above the exposed adhesive layer 24 and the optical recording member 20, and the print recording medium 19c is formed.

(0036)

In another alternative when the heat insulation layer 28c is created on top of the print display surface 20a of the optical recording member 20, the base material 22 is affixed with the adhesive layer 24 on top of that, and the thermosensitive color development layer 23 is created above that in this construction. In this case, the adhesive layer 24 will not be necessary if the employed heat insulation layer 28c has adhesive characteristics.

(0037)

In another alternative of the print recording medium 19c, the heat insulation layer 28c is created on top of the print display surface 20a of the optical recording member 20 and the color development member is prepared with an adhesive layer 24. In this case, the prepared color development member has a thermosensitive color development laye3 23 employed on one

surface of the base material 22. The construction of the print recording medium 19c is formed when the base material of this type of color development member is affixed with an adhesive layer 24 on top of the heat insulation layer 28c. Adhesive layer 24 will again not be required in this case if the employed heat insulation layer has adhesive characteristics.

(0038)

Figure 4 shows a cross-sectional drawing used to explain the heat insulation effect in the print recording medium 19b, 19c. During printing, the thermal head 11 is in contact with the print recording medium 19b, 19c, and the heat generated from the thermal head 11 is conveyed from the thermal head 11 to the thermosensitive color development layers 23 and color development material 21 of the recording medium 19b, 19c. Because the heat is transferred from a high-temperature part to a low-temperature part, it will be transferred from the thermosensitive color development part 23 and color development part 21 to the optical recording material 20, but because heat insulation layers 28b, 28c are employed according to the second mode of the print recording medium 19b 19c, the amount of heat that is transferred to the optical recording member will be reduced by the heat insulation layers 28b, 28c. Accordingly, this enables to prevent damage from being caused by heat to data recorded on the optical recording layer 20.

(0039)

For example, if direct printing was performed to an optical recording part 20 by using a printing device, the recorded data was destroyed under the conditions listed below. The temperature of the recording head at that point during the printing conditions was approximately in the range of 200°C ~ 250°C.

(0040)

(Printing Conditions When Recorded Data Was Destroyed)

Head voltage: 16 V
Head energizing energy control: control in stages depending on how many times 1 dot ON/OFF is repeated (the maximum number of repetitions is 25), the bias energizing time period shown in Figure 5 is 150 μs, energizing OFF time period T2 is 24 μs, and energizing ON time period T3 is 40 μs
Head energizing repeated: 100 times
Printing time period: less than 50 lines
Head resistance value: 125 Ω
Amount of electric energy consumed by the head: 0.204 W
Energy amount per 1 dot: 0.978 mJ (energizing applied 100 times)

Under the conditions described above, the number of energizing repetitions during the maximum density was 200 times, and the head temperature when 100 lines was printed

continuously was 300°C. At this point, the energy amount created per 1 dot was 1.711 mJ (for 200 energizing repetitions). Accordingly, it was determined that a heat insulation layer was required as the gap between the temperature when recorded data was destroyed and the maximum temperature applied by the head was 50°C ~ 100°C.

(0041)

If this temperature difference of 50°C ~ 100°C was completely absorbed by the heat insulation layer 28b, 28c, for instance by using heat insulation layers 28b, 28c made of acrylic resin with a heat conductance of 0.17 ~ 0.25 ($W \cdot M^{-1} \cdot K^{-1}$), a film thickness of more than 0.14 mm is required. In addition, when rubber was used with a heat conductance of 0.1 ~ 0.2 ($W \cdot M^{-1} \cdot K^{-1}$), the required thickness was more than 0.11 mm. One has to take into account also the fact that in reality, the absorbed heat generated by the thermosensitive color development layer 23, color development member 21, etc., will be also discharged, since this will also determine the thickness layer of heat insulation layer 28b, 28c. Therefore, it is possible to set the thickness thinner than in the above mentioned layer. A similar heat insulation layer 28b and 28 can be realized for example by using an acrylic adhesive agent, or an adhesive layer on both surfaces of a rubber or foam base material, or with a tape on both surfaces having foaming characteristics, etc.

(0042)

Figure 6 (a) is a cross-sectional drawing showing a print recording medium in Embodiment 3 of this invention. The print recording medium 19d has a construction that is basically identical to the print recording medium 19b of Embodiment 2, but it is provided with an elastic layer 29 instead of the heat insulation layer 28b between the optical recording member 20 and the thermosensitive color development layer 23. The print recording medium 19d is formed for instance so that after the elastic layer 29 is created on top of the optical recording member 20, the thermosensitive color development layer 23 is created.

(0043)

Figure 6 (b) is a profile diagram showing another example of the print recording medium 19e in Embodiment 3 of this invention, The print recording medium 19e is constructed basically in the same manner as the print recording medium 19c of Embodiment 2, but an elastic layer 29e is created instead of the heat insulation layer 28c between the optical recording member 20 and the color development member 21.

(0044)

For example, while the print recording medium 19e is an elastic layer 29e employed on the print display surface 20a of the optical recording member in the same manner as in the other example in Embodiment 2, the construction is formed by affixing an elastic layer 29e on top of

the optical recording member 20 and an exposed adhesive layer 24 after a separation paper is peeled off from the color development member.

(0045)

As an alternative, the print recording medium 19e is created with an elastic layer 29e deployed on top of the print display surface 20a of the optical recording member 20, on top of that is employed an adhesive layer 24 and a base material is affixed thereto. The construction is then created by using the thermosensitive layer 23 on top of that. In this case, it is again not necessary to use an adhesive layer 24 if the elastic layer 29e has adhesive characteristics.

(0046)

In yet another alternative, the construction of the print recording medium 19e is created so that an elastic layer 29e is created above the print recording layer of the optical recording member 20 and an adhesive layer 24 is employed, and the color development member is prepared in the same manner as in the other example in Embodiment 2, by affixing an adhesive layer 24 on top of the base material 22 and the elastic layer 29e of the color development member and. The adhesive layer 24 is again not necessary in this case if the elastic member 29e has elastic characteristics.

(0047)

Figure 7 is a drawing explaining the elastic effect of the print recording media 19d, 19e. Figure 7 (a) is a top view of a cutout in one part of the print recording media 19d, 19e, Figure 7 (b) shows a cross-sectional view along the line I - I in Figure 7 (a), and Figure 7 (c) is a cross-sectional view along the line II - II in Figure 7 (a). During printing, the thermal head 11 is in contact with the print recording media 18d, 19a. While warpage will be normally generated by the optical recording member 20, since elastic layers 29d, 29e are deployed on the printing recording media 19d, 19e in Embodiment 3, said warpage can be absorbed by the elastic layer 29d, 29e. Accordingly, this prevents reduced adhesiveness of the thermal head 11 to the print recording media 19d, 19e. In addition, if for example fluctuations of the thickness are generated on the other periphery and on the inner periphery of the optical recording member 20, the differing thickness can be absorbed by said elastic layers 29d, 29e. Accordingly, this prevents reduced adhesiveness due to a different thickness, thus enabling a high quality of the print product.

(0048)

If warpage or the like corresponding to 20 μm is generated on the optical recording member 20, in order to induce adhesion of the thermal head along the entire periphery of the print recording media 19d, 19e only by the elastic characteristics of the elastic layers 29d, 29e, when the pressure applied by the thermal head 11 onto the print recording media 19d, 19e is set

to 1.2 kg, the contact surface area is set to 20 mm^2, and rubber with an elastic coefficient of 10 ~ 30 kgf/cm^2 is used as the material of the elastic layers 29d, 29e, a thickness above 0.1 mm will be required for the elastic layers 29d, 29e. Because in reality, the film thickness of the elastic layer 29d, 29e is determined also by factors such as the elasticity of the thermosensitive color development layer 23 and the color development member 21, a thinner film thickness can be set than the above mentioned film thickness. Such elastic layers 29d, 29e can be realized for example in the form of a foaming double-faced tape, etc., wherein an adhesion layer is created on both surfaces of the base material such as an acrylic adhesive, rubber or a material with foaming characteristics.
(0049)

Figure 8 is a cross-sectional view showing a print recording medium 19f in Embodiment 4 of the present invention. The print recording medium 19f is provided both with an elastic layer 29f and a heat insulation layer 28f deployed between an optical recording layer 20 and a thermosensitive color development layer 23. The print recording medium 19f has a heat insulation layer 28f deployed for example on top of the optical recording member 20, and after the elastic layer 29 has been formed on top of that, a thermosensitive color layer 23 is formed to create the structure. In addition, the elastic layer 29f and heat insulation layer 28f can be also created in reversed order.

(0050)

Figure 8 (b) shows a cross-sectional view of yet another example of a print recording medium in Embodiment 4 of this invention. A print recording medium 19 g is provided both with an elastic member 29 g and a heat insulation layer 28g deployed between the optical recording member 20 and color development member 21.

(0051)

If for example the print recording medium 19g is provided with a heat insulation layer 28g created on top of a print display surface 20a of an optical recording member 20, and an elastic layer 29g is deployed on top of that so that the color development member is prepared in the same manner as in another example shown in Embodiment 2, the construction can be created by affixing the elastic layer 29g on top of the optical recording member 20 with an exposed adhesive layer 24 once a separation paper is peeled off from the color development member. In addition, the heat insulation layer 28g and the elastic layer 29g can be also created in reversed order.

(0052)

As an alternative, the print recording medium 19g can be formed so that the heat insulation layer 29g and the elastic layer 28g are employed on top of the print display surface 20a of the optical recording member 20 in this order, the adhesive layer 24 is employed on top of

the elastic layer 29g and base material 22 is affixed. In addition, the construction is created by deploying the thermosensitive color development layer 23 on top of that. The heat insulation layer 28g and elastic layer 29g can be also created in reversed order. Finally, if the heat insulation layer 28g and elastic layer 29g are provided with adhesive characteristics on the side of the base material 22, adhesive layer 24 is not required.

(0053)

In another alternative, the print recording medium 19g can be also provided with the heat insulation layer 28g and elastic layer 29g on top of the print display surface 20a of the optical recording member 20 in this order, so that an adhesive layer 24 is employed, and the color development member is prepared in the same manner as in another example shown in Embodiment 2, and the construction is created by affixing the adhesive layer 24 on top of the elastic layer 29g and the base material 22 of the color development member. In addition, the heat insulation layer 28g and elastic layer 29g can be also created in reversed order. Finally, adhesive layer 24 is not required if the heat insulation layer 28g and the elastic layer 29g have adhesive characteristics on the side of the base material 22.

(0054)

In the print recording medium 19f, 19g of Embodiment 4, the heat that is transferred to the optical printing member 20 during printing is reduced by the heat insulation layers 28f, 28g, while warpage of the optical recording member 20 or a different thickness causing reduced adhesiveness of the thermal head 11 can be prevented by the elastic layers 29f, 29g. Therefore, this prevents data recorded on the optical recording member 20 from being destroyed by the heat, enabling printing with a high quality of the product.

(0055)

With respect to the print recording media 19f, 19g, the construction of the heat insulation layers 28f, 28 g is formed in the same manner as in said heat insulation layer 28b, 28c, and the construction of the elastic layers 29f, 29g is formed in the same manner as in said elastic layers 29d, 29e.

(00056)

(Effect of the Invention)

As was explained above, because this invention employs a construction of a print recording medium wherein a very thin color development layer is deployed on top of a relatively thick color development member, while the thickness of the print recording medium is approximately identical specifications for an optical recording medium, the print recording medium can be loaded into and removed from a playback device and recording of data can be

performed with safely and with reliability of reproduction characteristics.

(0057)

This invention also makes it possible to prevent with a heat insulation layer heat that is generated by a thermal head or the like during printing of a title or the like from being transferred to the optical recording member. This in turn enables to prevent of data recorded on the optical recording member from being destroyed by heat.

(0058)

Furthermore, because the adhesiveness of the thermal head to the color development layer during printing is increased by the elastic layer, this makes it possible to compensate for reduced adhesiveness which can be caused by factors such as warpage or differing thickness of the optical recording member, enabling a high quality of the print product. Also, because a heat insulation layer is employed together with an elastic layer, heat generated by a thermal head and the like can be prevented from being transferred to the optical recording member, enabling to increase the adhesiveness between the thermal head and the color development layer and to obtain a high quality of the print product while destruction of the recorded data by heat is prevented.

(0059)

Further still, because a heat insulation layer is used between an optical recording member and a color development member according to this invention, this makes it possible to prevent heat from being transferred from the thermal head and the like to the optical recording member.

(0060)

Also, because an elastic member is used according to this invention between an optical recording member and a color development member, adhesive characteristics between the thermal head and the color development layer can thus be improved.

(0061)

Furthermore, because a heat insulation layer and an elastic layer are employed according to this invention between an optical recording member and a color development member, this makes it possible to prevent heat generated by a thermal head and the like from being transferred to the optical recording member, while adhesiveness between the thermal head and the color development layer can be increased at the same time.

(Brief Explanation of Figures)

(Figure 1)

Figure 1 (a) is a cross-sectional diagram showing a print recording medium 19a in Embodiment 1 of this invention, Figure 1 (b) is a cross-sectional diagram showing in detail a thermosensitive color development layer 23 of the print recording medium 19a.

(Figure 2)

A perspective view showing a simplified construction of the rotary print device 10.

(Figure 3)

Figure 3 (a) is a cross-sectional diagram showing the print recording medium 19b in Embodiment 2 of the present invention, Figure 3 (b) is a cross-sectional view of a print recording medium 19c in Embodiment 2 of this invention.

(Figure 4)

A cross-sectional diagram which serves to explain the heat insulation effect in print recording medium 19b, 19c.

(Figure 5)

A timing chart showing a bias energizing time period T1, energizing OFF time period T2, and energizing ON time period T3.

(Figure 6)

Figure 6 (a) is a cross-sectional diagram indicating a print recording medium 19d in Embodiment 3 of the present invention, Figure 6 (b) is a cross-sectional diagram showing another example of Embodiment 3 in this invention.

(Figure 7)

A diagram used to explain the elastic effect in the print recording media 19d, 19e.

(Figure 8)

Figure 9 (a) is cross-sectional diagram indicating a print recording medium 19f in Embodiment 4 of this invention, Figure 8 (b) is a cross sectional diagram showing a print recording medium 19g in another example of Embodiment 4 of this invention.

(Explanation of Symbols)

19 a ~ 19g	print recording medium
20	optical recording member
20a	print display surface
20b	data recording and reading surface
21	color development member
22	base material
23	thermosensitive color development layer
23a	yellow color development layer
23b	magenta color development layer
23c	cyan color development layer
24	adhesive layer
25	organic pigment layer
26	optical reflection layer
28b, 28c, 28f, 28g	heat insulation layers
29d, 29e, 29f, 29g	elastic layers
M	disk-shaped print recording medium

(Figure 1) (a) and (b)

(Figure 2)

(Figure 4)

(Figure 4)

(Figure 3) (a) and (b)

(Figure 6) (a) and (b)

(Figure 8) (a) and (b)

(Figure 7) (a), (b) and (c)